REMARKS

Claims 1-6 and 8-17 are all the claims pending in the application.

Initially, it is respectfully requested again that the Examiner indicate that the drawings submitted on April 9, 2004 have been accepted.

I. Response to Rejection of Claims 1-6 and 8-17 under 35 U.S.C. § 103(a)

Claims 1 and 2 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Smits (4,359,481) and Kenzo (JP 8-298925).

In addition, claims 3-6 and 8-17 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Smits, Kenzo, and further in view of Kenzo (JP 10-179016).

Applicants respectfully traverse the rejection.

The basis for the present invention is the discovery that at least the effects of the present invention according to the objects a) increase flavor complexity; b) prevent formation of metmyoglobin during frozen storage; and c) prevent formation of natural odors after thawing a, b, and c listed below are demonstrated by dissolving a gas component of dry-distilled smoke in the smoke solution to achieve complete dissolution (a state in which poorly soluble gas is completely dissolved in a liquid phase and is in equilibrium with the gas phase at normal pressure according to Henry's law).

In the present invention, a saturated solution is formed by a liquid in which sodium citrate, vitamin C, and other salts and the like are dissolved in a state in which the gas component of dry-distilled smoke after the soot and tar of the smoke are removed by a spray of water is pressurized or at normal pressure without entrainment of air. Consequently, a flavor is present that is strong enough to be directly tasted. The liquid component and the gas component of the smoke are both present in the liquid, and as a result, the present invention provides a novel process to obtain the effects of a smoking process using a smoke solution.

This has not been disclosed, taught or suggested in the conventional industry or in specialized publications.

The present invention allows the combination of a liquid smoking process and a freezing preservation technique, and makes it possible to maintain a degree of freshness that enables raw consumption (food product that can be consumed without heating).

Contrary to the Examiner's position, it is respectfully submitted the one of ordinary skill in the art would not be motivated to combine the references.

Smits discloses the use of a Fessman smoke generator. The Fessman smoke generator involves bringing dry steam into direct contact with the wood material, and is characterized as a steam-type method of direct heating. Additionally, the smoke obtained by Fessman is changed to a wet steam. In addition, Smits disclose that the flavoring is obtained, preferably in the presence of steam. Thus, one of ordinary skill in the art would not be motivated to modify Smits as suggested by the Examiner, particularly based on the differences between a Fessman smoke generator and the one disclosed in Kenzo.

Additionally, the smoke generating device of Kenzo is a device for generating dry-distilled smoke in which the air is cut off, and there is no disclosure regarding dissolving a smoke component to form a smoke solution.

Furthermore, there are differences between the present invention and Smits. Smits focuses on liquid smoke, but those of the aggregated components that are left behind by the removal of tar as a polymer substance by the temperature difference are assumed to be further adjusted for pH and used, and the main purpose thereof is considered to be aromatization and sterilization by the liquid component in the smoke. For example, the principal aromatizing component is the bromine oxide smoke component, which corresponds to secondhand smoke in tobacco.

In the present invention, however, dry-distilled gas is generated by indirect pyrolysis of wood while avoiding entrainment of air; and then tar, soot, and other unwanted substances are removed by a water spray, and primarily the gas components are dissolved in an aqueous solution that is furthermore continuously used as a perfusate. The characteristic objects of the present invention are to improve flavor, prevent formation of metmyoglobin during freeze preservation, and prevent natural odors after thawing. Since dry-distilled smoke is not accompanied by oxidation, the pyrolyzed wood components form smoke without undergoing further changes, and correspond to the mainstream smoke, for example, of tobacco, and the components thereof are entirely different. The smoke solution created by the dry-distilled smoke is therefore treated as smoke flavoring in terms of Food Sanitation Law, and as described in the previous written response, the smoke solution obtained through the use of the smoke that is accompanied by oxidation is distinguished as "liquid smoke." Thus, the present invention does not use the liquid smoke as in Smits, but uses smoke flavoring to perform smoking with a smoke solution to improve flavor, prevent formation of metmyoglobin during freeze preservation, and prevent natural odors after thawing.

A main point of the present invention is to dissolve the poorly soluble gas components of smoke in an aqueous solution and to achieve a practical level of meat color stabilization. Red chromoprotein (primarily myoglobin Mb) is concentrated in the red meat of fish meat and has the function of receiving and storing oxygen from hemoglobin (Hb), and is known to occur as reduced Mb (dark purple) Fe^{++} and oxidized Mb (cherry red) Fe^{++} in the presence of oxygen, and then to change to metmyoglobin MetMb (brown) Fe^{+++} as oxidation progresses after death.

This Mb usually reacts at coordinate bonds with oxygen in the body, the affinity thereof is relatively low, and the Mb has the function of separating and bonding according to changes in pH or carbon dioxide gas quantity to stably supply oxygen to the muscles. This reaction is a

reversible reaction. Mb is also known to bond with numerous types of substances and to have a characteristic polarization spectrum. (It is a reversible reaction involving substances that have different affinities and possess an unshared electron pair in which there are two extra electrons in the atoms of the molecule, e.g., oxygen, carbon monoxide, nitric oxide, cyan, ammonia, pyridine, hydrogen sulfide, and numerous others.)

These numerous Mb types in which coordinate bonding occurs are more stable than oxygen and are less susceptible to a change to metmyoglobin. Mb changes to metmyoglobin ($Fe^{++} \rightarrow Fe^{+++}$), the Mg porphyrin ring is then split, numerous types of unpleasant odors occur, and the Mb is irreversibly broken. In the medical field, carbon monoxide is coordinate bonded and stabilized in long-term storage of human blood and substituted with oxygen at the time of use.

For example, when yellowtail sashimi is left at room temperature for several hours at a party or the like, it is often due to the breakdown of Mb that metmyoglobin is gradually formed, followed by a continuously occurring unpleasant odor and the wafting of an unpleasant odor (the natural odor particularly of parts close to the spine) in the mouth due to unpleasant flavor components when the fish is eaten. These changes take place through a completely different mechanism than spoilage.

On the other hand, the ratios of components generated vary according to the formation conditions (particularly the wood type, moisture, temperature, oxygen, and other conditions) of the smoke components, and the smoke components are therefore classified as additives in which the primary components are not present. However, the generated gas is stably reproduced at a nearly experimental level of purity in a constant temperature range by the smoke generation device used in the present invention, and the primary components thereof are components similar to those of the previously submitted response; namely, steam, carbon

dioxide, carbon monoxide, and lower hydrocarbons including methane, as well as hydrogen, pyroligneous acid vapor, and the like. Due to the absence of air, smoke is generated in which there is extremely minimal nitrogen, and the concentration of the gas components is not reduced by air, and therefore remains high in use.

The smoke usually does not have the normal smoke odor, and the odor is largely controlled by the type of wood, but the smoke eventually takes on a normal smoke odor (a burnt wood odor) when released into the atmosphere. When dry-distilled smoke is directly sniffed prior to contact with air, a relatively mild but unpleasant odor (which produces a unique freshness when suitably mild) occurs when coniferous material is used, and broadleaf dry-distilled gas produces an extremely unpleasant odor that induces nausea, but complexity is added to the flavor when the smoke is brought into contact with fish meat.

Additionally, in the present invention, the perfusate is perfused through the capillaries of the entire body via the cardiac arteries of the fish body, and the liquid components as well as the gas components of smoke are used as a smoke solution, while maintaining a completely saturated state and normal pressure of the liquid components and gas components in the smoke at which gas bubbles do not form. Normal functioning of the body circulatory system is a condition for a perfusion process to be applicable, and since the circulatory system contracts and is compressed in states of extreme excitement or anxiety, the same technique is considered not to be usable in such states. Accordingly, wild fish must be restored to a calm and normal state with stressors removed, and in this regard, farm-raised fish are easier to handle than wild fish.

Exemplary calculations regarding perfusion will be determined using yellowtail as the model, as yellowtail is the largest of the fish that are farmed in Japan.

Table (2): Yellowtail row from Table (1) (mg/100 g of meat)[1]

Type	Regular meat		Spinal meat	
	Mb + Hb	%Mb	Mb + Hb	%Mb
Yellowtail	12-30	100	400-800	96-99

Yellowtail is treated as a white fish, but the red pigment Mb is concentrated under the skin and near the spine. The commercial size for yellowtail is about 5.5 kg to 9 kg, but a size of 6 kg/fish will be used for convenient calculation. Perfusion is a technique in which the perfusate is passed through the blood vessels of the entire body including the internal organs, and is not a method for processing only the area near the spine. Accordingly, when about 1.5 times the weight of the fish in perfusate is used in practice, the hemoglobin Hb that is the blood pigment remaining in the white meat as well as in the meat near the spine is reduced to a level that it cannot be visually detected.

The following equation assumes that the meat near the spine and the red meat of the skin (including the meat near the spine) account for a maximum of 3% of the total mass of the fish.

$$6000\ g \times 3\% = 180\ g \qquad \text{Eq. (1)}$$

The ratio of the Mb quantity differs in the regular meat and the spinal meat, but in the following equation, the Mb quantity of the spinal meat is the maximum value of Table (2) when carbon monoxide is coordinated in all of the spinal meat and the Mb quantity is the value necessary to stabilize the color.

$$\text{From Eq. (1), } 180\ g \times 800\ mg/100\ g = 1.44\ g \qquad \text{Eq. (2)}$$

The following is based on the known value of 1.7 mg (1.46 mL) of carbon monoxide that forms a coordinate bond per 1 g of Mb.

[1] K. Hashimoto, "Chromoproteins," Fisheries Science Series 13, p. 28

From Eq. (2), 1.44 g × 1.7 mg/g = 2.448 mg = 0.002448 g Eq. (3)

From Eq. (3), 0.002448 g/28 (quantity of carbon monoxide molecules) × 22.4 (mol volume) = 1.9577 mL Eq. (4)

Thus, at a 100% concentration of carbon monoxide and a volume of 1.9577 mL, the Mb that is the red pigment of the yellowtail (6 kg/fish) can be converted to COMb, and the color can be stabilized.

Carbon monoxide has over 100 times the affinity of oxygen, and coordinate bonding to Hb is complete at a gas concentration of about 2% in the experimental values. In the smoke (Ficher, ding, polyt being quoted as an example) produced by the present technique, carbon dioxide is most absorbed according to the degree of water spray, and since other gases are poorly soluble gases, the concentration thereof increases in relative fashion.

Ficher, ding, polyt 2.3 8 (1995) (%)			Applicant's measured value (%)
Carbon dioxide gas:	59.0%		15 to 20%
Carbon monoxide:	33.0		40 to 43
Methane (CH_4):	3.5	lower hydrocarbons (CnHn+2) including methane:	10 to 17
Hydrogen:	3.0		3 or less
Pyroligneous acid:	1.5	aldehydes	1 or less
Oxygen:			1 or less
Nitrogen and others			---

As for carbon monoxide, when the solubility is 0.0214 (mL/H_2O1mL), the quantity of smoke solution used to process one yellowtail fish is approximately 9 L (9000 mL), and the quantity of carbon monoxide dissolved in the smoke solution is indicated by the following equation when the carbon monoxide concentration in the smoke of the applicant that dissolves at normal pressure is calculated as 40%.

$0.0214\ (mL/H_2O \cdot 1mL) \times 40\% \times 9000\ mL = 77.04\ mL$ Eq. (5)

The amount of physically dissolved carbon monoxide when 80% of the fish meat is assumed to be water is indicated by the equation below.

$0.0214\ (mL/H_2O \cdot 1mL) \times 40\% \times 6000\ g \times 80\% = 41\ mL$ Eq. (6)

The sum of the physically dissolved amount in the fish and the amount that is coordinate bonded to Mb is indicated below.

(Eq. (6)) 41mL + (Eq. (4)) 1.9577 mL = 42.96 mL

The carbon monoxide dissolved in the perfusate is (Eq. (5)) 77.04 $mL/H_2O \cdot 9000$ mL, the sum of the physically dissolved amount and the Mb coordinate bonded amount in the fish body is significantly exceeded, and a state occurs in which Mb is also included in the water in which the carbon monoxide is physically dissolved after the end of perfusion. It is therefore apparent that there is enough poorly soluble gas for the smoke solution to stabilize coordinate bonding of the Mb in the moisture and meat of the fish body.

Accordingly, the smoke solution of the present invention is considered to have uniqueness in terms of usage, since the gas components diffuse until reaching equilibrium with the atmospheric concentration when the gas components are dissolved and allowed to stand.

When left in the atmosphere as described above, the physically dissolved components are discharged into the atmosphere by a reversible reaction, the carbon monoxide that is coordinate bonded to the Mb in a state of equilibrium with the physical dissolution eventually releases into the atmosphere over time, metmyoglobin formation occurs, and the product value is lost. The effects for preventing metmyoglobin formation are therefore demonstrated only in a frozen storage state. After thawing, the physically dissolved carbon monoxide is released into the atmosphere over time, and when equilibrium with the COMb in the fish meat is lost, the COMb of the reversible reaction changes to MetMb via reduced Mb, and browning occurs. The

rate of browning is the same as that of oxygenated Mb, the color is over-maintained after thawing, and there is no possibility of food poisoning due to bacterial proliferation.

Since Smits makes no mention of this color stabilization and meat coloration, it is respectfully submitted that the effects of flavor improvement, color maintenance, and delay of natural odor through the use of a smoke solution (preservation, perfusion) would not have been expected by one of ordinary skill in the art.

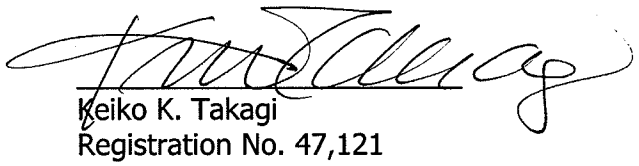
For at least the above reasons, it is respectfully submitted that Smits and/or Kenzo fail to teach or suggest the present invention, and that claim 1 and the claims depending therefrom are patentable over the cited art.

Accordingly, it is respectfully requested that the rejection of claims 1-6 and 8-17 be withdrawn.

II. Conclusion

In view of the above, reconsideration and allowance of claims 1-6 and 8-17 is respectfully requested. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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